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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P3S2004392	FOR FURTHER ACTION	See Form PCT/PEA/416
International application No. PCT/JP2005/004733	International filing date (day/month/year) 10.03.2005	Priority date (day/month/year) 11.03.2004
International Patent Classification (IPC) or national classification and IPC INV. F01N9/00 F01N3/025 F01N3/08 F02D41/02		
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 5 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand 14.12.2005	Date of completion of this report 24.04.2006	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Torle, E Telephone No. +49 89 2399-6943	



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/JP2005/004733

Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-37 as originally filed

Claims, Numbers

1-11 received on 13.04.2006 with letter of 13.04.2006

Drawings, Sheets

1/9-9/9 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☒ the claims, Nos. 1
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing *(specify):*
 - ☐ any table(s) related to sequence listing *(specify):*
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing *(specify):*
 - ☐ any table(s) related to sequence listing *(specify):*

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/JP2005/004733

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-11
	No: Claims	
Inventive step (IS)	Yes: Claims	1-11
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-11
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

- 1 Reference is made to the following document:
D1 : WO 03/001038 A (ISUZU MOTORS LIMITED) & EP1400663 A1

2 **INDEPENDENT CLAIM 1**

Document D1 discloses a regeneration controller for eliminating particulate matter accumulated in an exhaust purification apparatus.

From this, the subject-matter of independent claim 1 differs in that it first heats the exhaust purification apparatus by constantly keeping the air fuel ratio in the exhaust system low. When the estimated accumulation amount is within a mode change range the air fuel ratio is intermittently lowered for burning up the particular matter.

The subject-matter of claim 1 is therefore novel (Article 33(2) PCT)
The problem to be solved by the present invention may be regarded as an alternative to the solution presented in document D1.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) since it appears not obvious, considering the prior art, to have a first mode constantly keeping the air-fuel ratio low and a second mode intermittently lowering the air-fuel ratio.

3 **DEPENDENT CLAIMS 2-10**

Claims 2-10 depend on claim 1 and are therefore also new and inventive.

4 **INDEPENDENT CLAIM 11**

Claim 11 is mutatis mutandis also new and inventive.

CLAIMS

1. (Amended) A regeneration controller for eliminating particulate matter accumulated in an exhaust purification apparatus that is arranged in an exhaust system of an internal combustion engine, the regeneration controller comprising:

a heating section for heating the exhaust purification apparatus to eliminate the particulate matter accumulated in the exhaust purification apparatus when an estimated accumulation amount is greater than a reference accumulation amount, wherein the heating section obtains the estimated accumulation amount by estimating the amount of particulate matter accumulated in the exhaust purification apparatus; and

a mode change section for changing exhaust purification apparatus heating modes when heating the purification apparatus if the estimated accumulation amount is within a mode change range, wherein:

an exhaust having an air-fuel ratio flows the exhaust system;

the mode change range is set in accordance with a comparatively small estimated accumulation amount; and

the mode change section changes the heating mode when the estimated accumulation amount is within the mode change range from a normal heating mode, for heating the exhaust purification apparatus by continuously keeping the air-fuel ratio in the exhaust system low, to a burn-up heating mode, for burning up the particulate matter by intermittently lowering the air-fuel ratio in the exhaust system.

2. (Amended) The regeneration controller according to claim 1, further comprising:

a difference detection unit for detecting exhaust pressure difference between an upstream side and a downstream

side of the exhaust purification apparatus;

wherein the mode change section determines whether to change the heating mode to the burn-up heating mode based on the exhaust pressure difference detected by the pressure detection unit.

3. (Amended) The regeneration controller according to claim 1, further comprising:

a difference detection unit for detecting at least one of an exhaust pressure difference and an exhaust temperature difference between an upstream side and a downstream side of the exhaust purification apparatus, in which the exhaust purification apparatus is a downstream side one of at least two exhaust purification apparatuses arranged in the exhaust system;

wherein the mode change section determines whether to change the heating mode to the burn-up heating mode based on at least one of the exhaust pressure difference and the exhaust temperature difference detected by the pressure detection unit.

4. (Amended) The regeneration controller according to claim 1, wherein the exhaust purification apparatus includes a downstream portion, the regeneration controller further comprising:

a difference detection unit for detecting exhaust temperature difference between an upstream side and a downstream side of the downstream portion the exhaust purification apparatus;

wherein the mode change section determines whether to change the heating mode to the burn-up heating mode based on the exhaust temperature difference detected by the pressure detection unit.

5. (Amended) The regeneration controller according to any one of claims 2 to 4, wherein the mode change section increases the estimated accumulation amount and continues the burn-up heating mode when the exhaust pressure difference or the exhaust temperature difference detected by the difference detection unit is greater than a mode change reference value.

6. (Amended) The regeneration controller according to any one of claims 2 to 4, wherein the mode change section limits the execution of the burn-up heating to a predetermined number of times when the exhaust pressure difference or the exhaust temperature difference detected by the difference detection unit is less than a mode change reference value.

7. (Amended) The regeneration controller according to any one of claims 2 to 4, wherein the mode change range includes a first mode change range and a second mode change range, which is narrower than the first mode change range, and wherein the mode change section:

increases the estimated accumulation amount and continues burn-up heating when the estimated accumulation amount is within the first mode change region and the exhaust pressure difference or the exhaust temperature difference detected by the difference detection unit is greater than the mode change reference value; and

executes the burn-up heating in a manner limited to a predetermined number of times when the estimated accumulation amount is within the second mode change region and the exhaust pressure difference or the exhaust temperature difference detected by the difference detection unit is less than a mode change reference value.

8. (Amended) The regeneration controller according to

claim 5 or 7, wherein the mode change section limits the number of times for increasing the estimated accumulation amount to a reference number of times or less.

9. (Amended) The regeneration controller according to claim 6 or 7, wherein the mode change section:

temporarily suspends execution of the burn-up heating when executing the burn-up heating in a manner limited to the predetermined number of times; and

determines that the execution of the burn-up heating has been executed the predetermined number of times regardless of an actual number of times the burn-up heating has been performed after a predetermined period elapses from when the execution of the burn-up heating is suspended and the estimated accumulation amount becomes zero.

10. (Amended) The regeneration controller according to claim 7, wherein the mode change reference value represents the exhaust pressure difference or the exhaust temperature difference that is predicted when the estimated accumulation amount is in the first mode change range.

11. (Amended) A method for eliminating particulate matter accumulated in an exhaust purification apparatus arranged in an exhaust system of an internal combustion engine, the method comprising:

estimating the amount of particulate matter accumulated in the exhaust purification apparatus to obtain an estimated accumulation amount;

determining whether the estimated accumulation amount is greater than a reference accumulation amount;

continuously keeping the air-fuel ratio in the exhaust system low by continuously adding fuel to exhaust when the estimated accumulation amount is greater than the reference

accumulation amount;

determining whether the estimated accumulation amount is less than or equal to a determination value, which is less than the reference accumulation amount; and

intermittently lowering the air-fuel ratio in the exhaust system by intermittently adding fuel to the exhaust when the estimated accumulation amount is less than or equal to the determination value.